Physical Properties of 134 Soils in Six Northeastern States

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PHYSICAL PROPERTIES OF 134 SOILS IN SIX NORTHEASTERN STATES

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From June 1954 to July 1955 the Vicksburg Infiltration Project[2/] collected and analyzed samples from 134 sites in six Northeastern States; the samples included 79 soil series and 114 soil types. This work was done to supply the U. S. Army with information needed for specialized research on military trafficability. The basic data are herein presented because of their interest to soil scientists generally. In addition, relationships between bulk density, and soil texture and organic content are presented.

The 79 series may be considered typical of the podsolic soils of the Appalachian Plateau Province in Pennsylvania and New York and the southern portion of the New England Maritime Province.

SITE SELECTION AND SAMPLING

Soil sampling sites were selected on the basis of state soil-association maps or county soil-survey maps and detailed highway maps. Criteria for selection were: (1) location on a principal soil series of the state or region; (2) within 5 miles of a weather substation; and (3) location near a readily accessible, well-marked road. An area of about 1/10 acre of uniform soil and cover type, not in cultivation at the time of examination, and located within 100 yards of a road was selected for each site.

Fifty-two sites were located in Pennsylvania, 33 in New York,

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2/ Maintained at Vicksburg, Mississippi, cooperatively by the Southern Forest Experiment Station, Forest Service, U. S. Department of Agriculture, and the U. S. Army Engineer Waterways Experiment Station, Corps of Engineers. Special acknowledgment is due the Soil Conservation Service for its cooperation in identifying the soils of this region. Also, acknowledgment is due the Kingston Research Center (Kingston, Pa.) of the U.S. Forest Service Northeastern Forest Experiment Station, for their assistance in carrying out this project.

17 in Connecticut, 18 in Massachusetts, 9 in New Hampshire, and 5 in Vermont. Their approximate locations are shown on the accompanying map (fig. 1), and a list of the series studied is given in table 1.

An effort was made to locate sites on fine-textured soils wherever possible, because of their potential trafficability problem. Also, instruments available for use in collecting samples for this study necessitated the selection of relatively more stone-free soils than is generally characteristic of this area. The soil, vegetation, and topography and land use of each site were described.

No sites were established on recently logged areas or on land in cultivation in 1954. Areas that had been cultivated some time within the 5 years preceding the survey were classed as cultivated previously—now grazed if they were being currently grazed by livestock; and as cultivated previously—now in hay if the cover was being cut for hay.

Areas that had not been cultivated for 5 years were classed as lightly grazed if they showed some animal use, as moderately grazed if they were being properly managed for grazing, and as hay if no grazing was apparent and the cover was cut for hay. When none of these disturbances had occurred within 5 years, the site was classed as undisturbed.

The soil properties were determined from bulk samples and 2-inch cores taken randomly from a 12 by 18-foot plot at each site. Bulk samples, composited from six locations, were taken with an open-side soil punch or soil auger from the 0 to 6-inch, 6 to 12-inch, and 12 to 18-inch layers for determination of mechanical analysis, plasticity constants, and organic-matter content. No samples were taken below 18 inches.

Duplicate undisturbed soil cores for bulk density and tension analysis were obtained at each site with the modified San Dimas core sampler (2) [3] for the 0 to 3-inch, 3 to 6-inch, 6 to 9-inch, and 9 to 12-inch depths, at a time when the soils were moist. Where present, unincorporated organic matter was scraped aside prior to sampling. Future references to organic matter, therefore, will apply only to that incorporated in the soil body.

The soils of these sites were subsequently examined and classified by Soil Survey field men in their respective areas. Soil scientists who cooperated in this study were: C. L. W. Swanson and A. E. Ritchie

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[3] Underlined numbers in parentheses refer to Literature Cited.

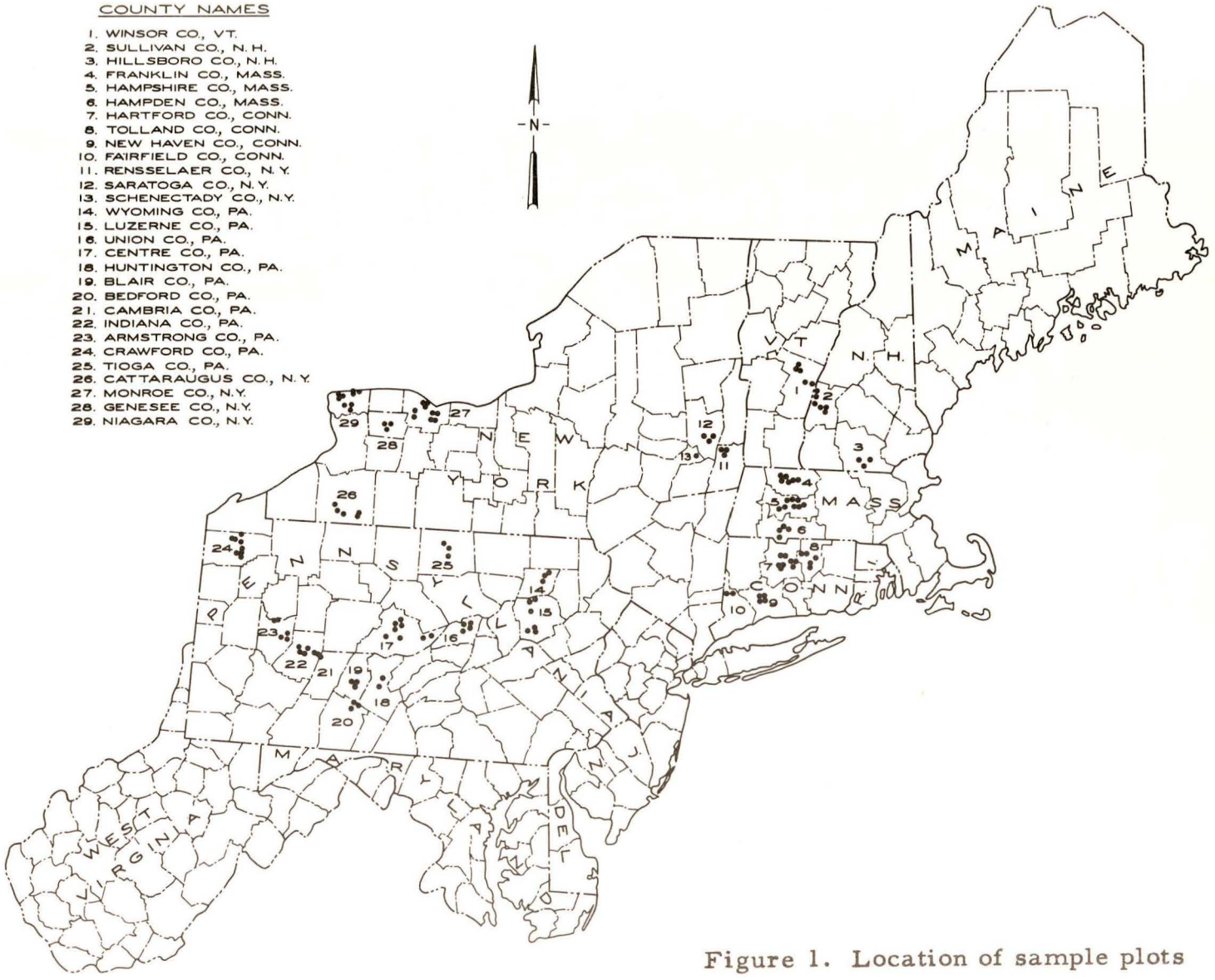

Figure 1. Location of sample plots

Table 1. Soil series studied

Series	State	Series	State
Acton	New Hampshire	Huntington	Pennsylvania
Agawam	Massachusetts	Junius	New York
	New Hampshire	Lackawanna	Pennsylvania
Albia	New York	Lakemont	New York
Andover	Pennsylvania	Leicester	New Hampshire
Araby	Pennsylvania	Lickdale	Pennsylvania
Atherton	New York	Lindside	Pennsylvania
Atkins	Pennsylvania	Lockport	New York
Berrien	New York	Ludlow	Connecticut
Braceville	Pennsylvania	Melrose	Massachusetts
Brinkerton	Pennsylvania	Melvin	Pennsylvania
Brockport	New York	Merrimac	Connecticut
Buxton	Vermont		Massachusetts
	Massachusetts		New Hampshire
Canfield	Pennsylvania	Ondawa	Massachusetts
Carver	Connecticut		Vermont
Chalker	Connecticut	Ovid	New York
Chenango	New York	Papakating	Pennsylvania
Cheshire	Connecticut	Philo	Pennsylvania
Clymer	Pennsylvania	Pope	Pennsylvania
Collamer	New York	Rhinebeck	New York
Colonie	New York	Romulus	New York
Colton	New Hampshire	Rumney	Connecticut
Colwood	New York		Massachusetts
Duffield	Pennsylvania		New Hampshire
Dunkirk	New York	Scarboro	Massachusetts
Dunmore	Pennsylvania		Vermont
Eel	New York	Schoharie	New York
Elkins	Pennsylvania	Sudbury	New Hampshire
Elmwood	Connecticut		Vermont
Enfield	Connecticut	Suffield	Massachusetts
Ernest	Pennsylvania	Swanton	New York
Frenchtown	Pennsylvania	Tioga	Pennsylvania
Fulton	New York	Tonawanda	New York
Galen	New York	Tyler	New York
Genesee	New York	Unadilla	New York
Gilpin	Pennsylvania	Walpole	Massachusetts
Gloucester	Connecticut		New Hampshire
Guthrie	Pennsylvania	Wheeling	Pennsylvania
Hadley	Connecticut	Wiltshire	Pennsylvania
Hagerstown	Pennsylvania	Winooski	New Hampshire
Hilton	New York	Wolcottsburg	New York
Holly	Pennsylvania	Woodbridge	Massachusetts
Hublersburg	Pennsylvania	Woostern	Pennsylvania
Hudson	New York		

in Connecticut; W. H. Coates, F. Filios, and H. Goodell in Massachusetts; W. H. Lyford and L. Garland in New Hampshire; A. J. Baur, D. R. Gardner, T. Fedak, R. Finley, B. Laux, W. Secor, J. Trach, and W. Wertz in New York; F. G. Loughry, J. Noll, J. Beard, and W. J. Steputis in Pennsylvania; M. Howard, Jr., and A. H. Kodess in Vermont.

ANALYSES

Mechanical analysis and organic-matter content were determined at laboratories of the Mississippi Agricultural Experiment Station. Plasticity constants were determined at the Soils Laboratory of the Waterways Experiment Station (7).

Mechanical analysis was determined by a combination sieve and hydrometer method. The separation of medium- and fine-textured particles was based on Bouyoucos hydrometer readings taken only 1 hour after the suspension was mixed and adjusted to a pH of 9.5 with 0.01N sodium hydroxide. The figures for fine-particle content may thus include a portion of the particles usually classified as fine silt. However, the medium- and fine-textured particles are reported as silt and clay respectively. The figures are expressed as percent of dry weight.

Texture class follows the terminology given in the U.S. Department of Agriculture Soil Survey Manual (5, p. 210). The following symbols are used alone or in combination:

S = sand

Si = silt

C = clay

L = loam

Organic-matter determinations were made by a modified Walkley rapid-dichromate oxidation method (4) and are expressed as percent of dry weight. The loss-on-ignition method, following modified procedures of the Association of Official Agricultural Chemists (1), was used for samples when the organic-matter content was determined as over 5 percent by the Walkley method.

Stone content was extimated visually in the field for soils having significant proportions of fragments coarser than 2 mm. In some cases, stones of boulder size occurred on the sites. The stone content is expressed as percent by volume for the 0 to 18-in. layer.

The plasticity constants of the 6 to 12-inch layer were expressed as moisture content in percent of dry weight.

The moisture held by the soil at zero tension (saturation) was determined by weighing the 2-inch cores after they had been soaked in a pan of water. As some water was lost during transfer, and as all pores are usually not filled by this method, these values are frequently less than the theoretical maximum. The 0.06 atm. tension values were determined by use of a tension table (3). The tension values are expressed in percent of dry weight.

RESULTS

Data on site characteristics and physical properties are given in tables 2 to 7 (one for each state). The published records of the listed weather stations give the approximate longitude, lattitude, elevation and climate of the sites. Additional information may be derived from the data as follows:

$$\frac{\text{Total pore space}}{\text{percent by volume}} = \left(1 - \frac{\text{Bulk density}}{\text{specific gravity} \times \text{unit weight of water}}\right) 100$$

(An estimated specific gravity of 2.65 may be used.)

$$\frac{\text{Saturation and 0.06 atm. tension value moisture contents,}}{\text{percent by volume}} = \frac{\text{percent by weight} \times \text{bulk density}}{\text{unit weight of water}}$$

$$\frac{\text{inches of water}}{} = \frac{\text{percent by volume} \times 6}{100}$$

$$\frac{\text{Detention storage}}{} = \text{moisture content at saturation - moisture content at field capacity.}$$

SUMMARY OF PROPERTIES

Average organic-matter contents, bulk densities, and saturation and 0.06 atm. tension values by broad vegetative and textural classes are given in tables 8 and 9. The 0.06 atm. tension values are frequently used as an approximate measure of field capacity. Textural classes were grouped as follows:

Coarse - loamy sand and sandy loam.

Medium - loam, silt loam, and sandy clay loam.

Fine - clay loam, silty clay loam, silty clay, and clay.

Unweighted averages were used to reduce the effect of the greater number of fine-textured soils.

The forest, herbaceous, and grass groupings are almost self-explanatory. "Forest" included locations that had a tree cover ranging in density from sites shaded by scattered trees to complete tree cover. "Herbaceous" sites were generally dominated by perennial or annual weeds, or cattails and marsh vegetation. "Grass" indicated sites that had a fairly complete cover of grasses, generally with a well-developed sod.

As can be noted in table 8, organic-matter content in the 0 to 6-inch depth was greater in soils of finer texture and in soils occupied by forest and herbaceous vegetation. Differences in the 6 to 12-inch depths were not so marked; notable is the greater reduction in organic content for the forested sites.

The main feature of the bulk-density comparison is the higher bulk density of the grass site in the 0 to 6-inch depth and the relative uniformity of bulk densities in the 6 to 12-inch depth.

In table 9, saturation values are similar for the vegetation and textural groupings. The 0.06 atm. values were markedly greater for medium- and fine-textured soils in both depths.

BULK-DENSITY REGRESSION

Soil bulk density is generally considered to be largely determined by soil texture and structure. The specific gravity of the materials making up the soil particles is also of importance. Fine-textured soils have lower bulk-density values than coarse-textured. Well-aggregated soils having a higher percentage of noncapillary pore space have also been observed to have a relatively low bulk density.

From these observations, the importance of soil organic matter in reducing bulk density may be deduced. Not only does organic-matter content tend to increase and stabilize soil aggregation, it also has a lower specific gravity than the inorganic particles of which the soil is composed.

The relationship between bulk density and soil organic matter

is given in figures 2 and 3 for each depth. In the 6 to 12-inch depth data, there was no evidence of a significant departure from a linear relationship between organic matter and bulk density; however, in the 0 to 6-inch depth this departure was highly significant. Relationships given in these figures are in general agreement with the findings of Trimble, Hale, and Potter (6), although they are not strictly comparable because of different sampling techniques.

Regression relationships between soil bulk density, organic-matter content, clay content, and sand content are given in table 10. Standard errors of estimate are about 0.13 gm per cc. and 0.14 gm per cc. for the two depths in order. With but the small difference in prediction error shown, use of the simplest linear equations—numbers 3 and 10—is indicated, even though the curvilinear relationship is best for the 0 to 6-inch depth. Addition of the textural variables did not improve the prediction to any significant degree. Correlation coefficients, given in table 11, are based on the same values used in computing regression equations 7 and 8 in table 10.

Better relationships between bulk density and organic-matter percentage or mechanical analysis might be expected if the samples for these characteristics had come from more nearly comparable layers of soil. Bulk samples for organic-matter content and mechanical analysis were taken from a 6-inch soil layer, while the bulk-density cores were from two 1-3/8-inch layers within that 6-inch layer. Approximately 3/4 inch of the surface soil, in the 0 to 6-inch layer, which may be expected to have a disproportionately high percentage of organic matter and the lowest bulk density, were not sampled for bulk density or moisture-holding capacity. The magnitude of the error so introduced cannot be directly assessed, but would probably be significant in forested soils.

Selection of the sites for study from accessible, relatively stone-free, uncultivated or abandoned areas cannot be considered to give an unbiased sample of the soil series studied or average soil conditions of the area. There is a strong possibility that such sites will have some degree of soil deterioration or adverse modification of the physical properties by compaction or erosion.

In view of some of the weaknesses of the sampling techniques, no firm basis for precise estimation of bulk density from other soil physical characteristics can be said to have been derived. However, the data may be used in the absence of any better information, and some general observations do appear to be justified.

The overwhelming importance of organic matter—and, by inference, management practices—in reducing the bulk density and thus

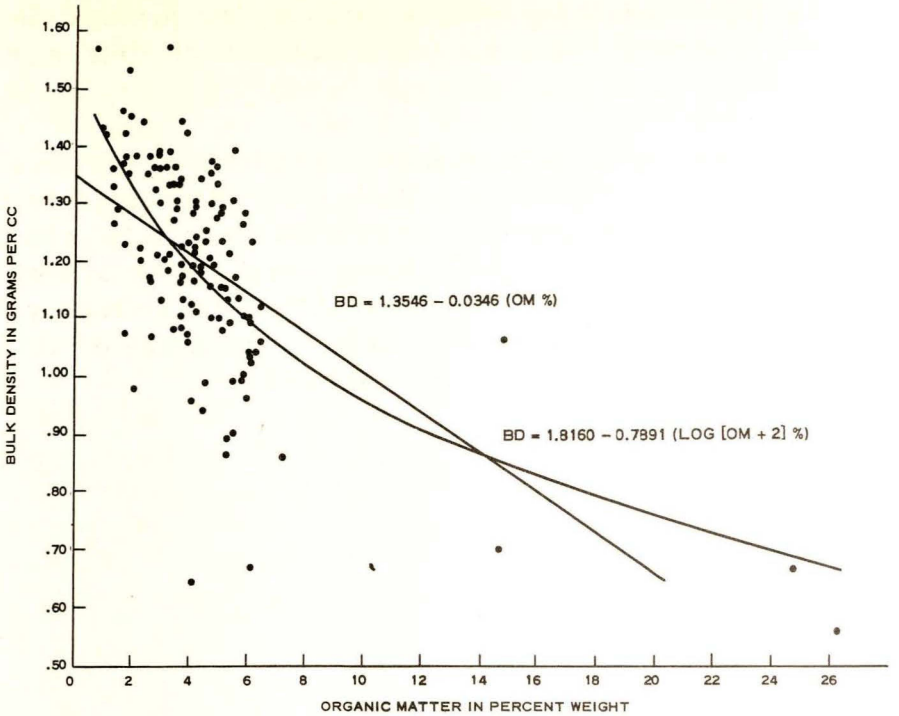

Figure 2. Regression of bulk density on percent organic matter for the 0 to 6-inch layer

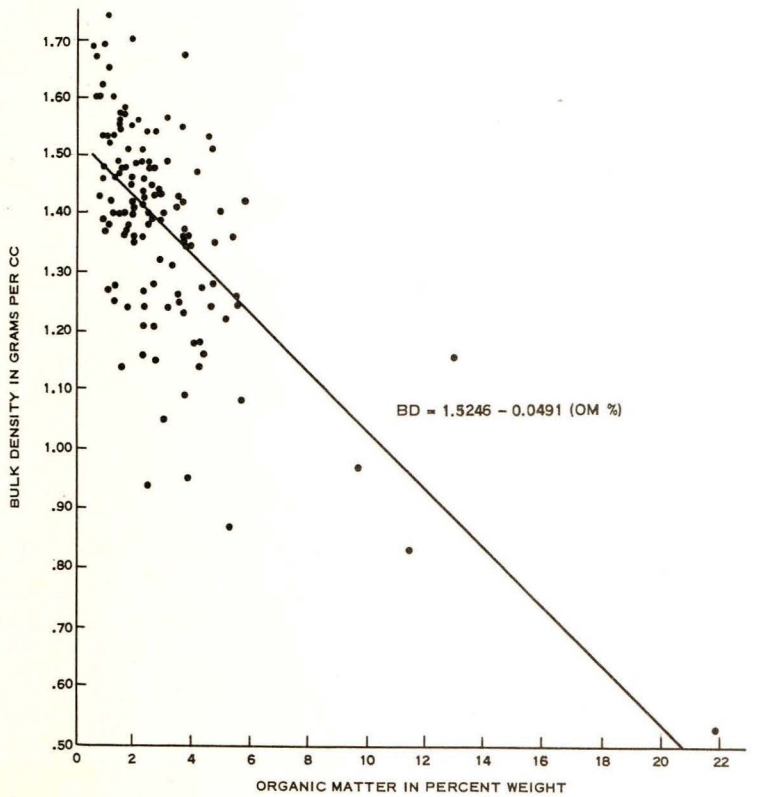

Figure 3. Regression of bulk density on percent organic matter for the 6 to 12-inch layer

increasing the total moisture-holding capacity of the soil is demonstrated. Soil texture has a less important roll in determining bulk density.

As the correlation coefficients show, probably the most important effect of texture in the surface soil is its influence upon organic-matter accumulation. The significant correlation of clay and organic-matter contents agrees with general observations that organic-matter accumulation is favored in finer-textured soils. This relationship does not appear to hold for the 6 to 12-inch depth. There the direct effect of texture on bulk density becomes more apparent.

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Table 2. Connecticut soil series: site descriptions and soil properties

Soil series	Site number	Weather station and county	Vegetation and land use	Topographic position and slope	Depths sampled inches	Texture class	Mechanical analysis by weight percent			Organic matter by weight percent	Stone content 0-18-in. depth by volume percent	Plasticity constants by weight percent			Bulk density grams per cc.	Soil moisture by weight, percent	
							Sand	Silt	Clay			Liquid limit	Plastic limit	Plasticity index		Saturation	.06 Atmosphere tension
Carver	112	Thompsonville, Hartford	Pine and oak, undisturbed	Terrace level	0-6	SL	77	14	9	1.77					1.07	60.8	28.7
					6-12	SL	74	19	7	.86	--		Non-plastic		1.48	31.3	13.2
					12-18	LS	77	17	6	.78					---	---	---
Chalker	109	Hartford W. B., Hartford	Grasses and legumes, hay	Bottom 3 percent	0-6	L	29	45	26	4.34					1.18	50.1	43.9
					6-12	L	29	48	23	2.23	--		Non-plastic		1.41	35.4	31.6
					12-18	SiCL	15	56	29	1.65					---	---	---
Cheshire	104	Mt. Carmel, New Haven	Ash and grasses, undisturbed	Upland 2 percent	0-6	C	34	24	42	5.34					1.09	53.5	38.7
					6-12	L	33	43	21	2.87	--		Non-plastic		1.32	37.6	29.0
					12-18	L	34	42	21	1.88					---	---	---
Cheshire	105	Mt. Carmel, New Haven	Grasses and legumes, hay	Upland 5 percent	0-6	L	48	35	17	3.27					1.39	34.1	24.5
					6-12	L	46	36	18	3.00	10		Non-plastic		1.44	32.2	26.9
					12-18	L	40	39	21	2.47					---	---	---
Elmwood	108	Hartford W. B., Hartford	Grasses and weeds, cultivated previously, now in hay	Terrace level	0-6	SiCL	15	56	29	4.05					1.12	52.9	44.4
					6-12	SiL	17	57	26	2.60	--		Non-plastic		1.39	36.5	32.0
					12-18	SiCL	16	55	29	.62					---	---	---
Elmwood	110	Hartford W. B., Hartford	Grasses and weeds, cultivated previously, now in hay	Terrace 3 percent	0-6	CL	39	33	28	3.62					1.19	48.3	39.4
					6-12	CL	33	29	38	1.05	--		Non-plastic		1.49	31.5	27.8
					12-18	C	13	23	64	.95					---	---	---
Enfield*	116	Thompsonville, Tolland	Oak and maple, undisturbed	Upland 3 percent	0-6	SiL	31	53	16	4.90					.68	112.7	73.9
					6-12	SiL	29	56	15	2.23	--		Non-plastic		1.12	51.4	37.9
					12-18	SiL	32	53	15	1.95					---	---	---
Enfield	117	Thompsonville, Tolland	Grasses and legumes, hay	Upland 3 percent	0-6	SL	58	30	12	3.00					1.30	40.4	30.1
					6-12	L	41	47	12	1.98	10		Non-plastic		1.41	34.8	27.1
					12-18	L	45	45	10	.62					---	---	---
Gloucester	118	Stafford Springs, Tolland	White pine, undisturbed	Upland 3 percent	0-6	SL	59	29	12	1.77					1.23	46.0	26.8
					6-12	SL	60	29	11	1.45	8		Non-plastic		1.57	27.1	19.1
					12-18	SL	63	28	9	.86					---	---	---
Hadley	111	Hartford W. B., Airport, Hartford	Grasses and legumes, hay	Bottom level	0-6	SiL	25	60	15	2.75					1.32	38.9	33.6
					6-12	SiL	29	57	14	2.23	--		Non-plastic		1.36	35.9	31.4
					12-18	SiL	24	59	17	2.08					---	---	---
Ludlow	106	Mt. Carmel, New Haven	Grasses and weeds, undisturbed	Upland level	0-6	L	46	35	19	4.52					1.25	43.5	30.8
					6-12	SL	54	28	18	2.23	--		Non-plastic		1.49	29.1	21.4
					12-18	L	33	50	17	1.45					---	---	---
Ludlow	107	Mt. Carmel, New Haven	Ash and oak, undisturbed	Upland level	0-6	L	41	36	23	3.96					1.06	57.4	32.9
					6-12	L	43	36	21	1.98	--		Non-plastic		1.36	36.2	24.5
					12-18	L	46	35	19	1.45					---	---	---
Merrimac	101	Danbury, Fairfield	Grasses and weeds, cultivated previously, now lightly grazed	Terrace 5 percent	0-6	L	48	39	13	4.05					1.19	46.4	38.7
					6-12	L	49	40	11	1.65	--		Non-plastic		1.37	35.8	27.6
					12-18	L	43	42	15	1.05					---	---	---
Merrimac	113	Hartford W. B., Airport, Hartford	Pine, oak, maple, undisturbed	Terrace level	0-6	SL	67	23	10	3.41					1.08	54.1	40.5
					6-12	L	43	44	13	1.05	--		Non-plastic		1.27	38.8	28.0
					12-18	L	45	43	12	.86					---	---	---
Merrimac	114	Thompsonville, Hartford	Grasses and weeds, undisturbed	Terrace level	0-6	SL	64	26	10	1.88					1.53	28.3	19.9
					6-12	SL	69	22	9	1.45	--		Non-plastic		1.56	26.7	19.1
					12-18	SL	71	20	9	.86					---	---	---
Merrimac	115	Thompsonville, Hartford	Spruce, maple, cherry, undisturbed	Terrace level	0-6	L	50	37	13	1.98					1.45	31.0	22.0
					6-12	SL	67	21	12	1.05	--		Non-plastic		1.65	24.0	18.9
					12-18	SL	64	27	9	.55					---	---	---
Rumney	102	Danbury, Fairfield	Grasses and weeds, undisturbed	Bottom level	0-6	L	45	41	14	3.96					1.07	57.6	48.4
					6-12	SL	55	31	14	1.25	--		Non-plastic		1.28	41.2	33.1
					12-18	SL	73	20	7	.95					---	---	---

* Bulk density and moisture content values questionable.

Table 3. Massachusetts soil series: site descriptions and soil properties

Soil series	Site number	Weather station and county	Vegetation and land use	Topographic position and slope	Depths sampled inches	Texture class	Mechanical analysis by weight percent			Organic matter by weight percent	Stone content 0-18-in. depth by volume percent	Plasticity constants by weight percent			Bulk density grams per cc.	Soil moisture by weight, percent	
							Sand	Silt	Clay			Liquid limit	Plastic limit	Plasticity index		Saturation	.06 Atmosphere tension
Agawam	121	Westfield, Hampden	Grasses and weeds, undisturbed	Terrace level	0-6	SL	72	22	6	1.77					1.42	35.0	23.1
					6-12	SL	64	27	9	1.45	--		Non-plastic		1.55	27.9	22.6
					12-18	SL	66	25	9	1.15					---	---	---
Buxton*	128	Amherst, Hampshire	Grasses and weeds, cultivated previously, now idle	Bottom level	0-6	SCL	53	24	23	2.87					1.36	36.5	29.2
					6-12	C	38	17	45	1.25	--		Non-plastic		1.53	29.0	24.3
					12-18	C	9	20	71	1.05					---	---	---
Melrose	130	Amherst, Hampshire	Elm, oak, maple, undisturbed	Terrace level	0-6	L	47	43	10	5.34					.89	73.7	51.6
					6-12	L	41	46	13	2.23	--		Non-plastic		1.16	49.7	37.9
					12-18	SL	55	37	8	1.33					---	---	---
Merrimac	119	Westfield, Hampden	Grasses and weeds, undisturbed	Terrace 2 percent	0-6	SL	55	34	11	4.70					1.15	50.1	32.2
					6-12	SL	54	30	16	2.75	--		Non-plastic		1.54	28.5	20.2
					12-18	SL	55	31	14	1.55					---	---	---
Merrimac	122	Westfield, Hampden	Oak, hickory, pine, undisturbed	Terrace level	0-6	SL	70	20	10	3.13					1.36	38.3	21.3
					6-12	SL	66	24	10	2.23	--		Non-plastic		1.51	30.3	16.4
					12-18	SL	57	31	12	1.05					---	---	---
Merrimac	131	Montague City, Franklin	Sassafras, undisturbed	Terrace level	0-6	SL	71	21	8	4.04					1.16	40.9	23.2
					6-12	LS	78	16	6	2.60	--		Non-plastic		1.45	29.9	13.9
					12-18	SL	73	19	8	2.35					---	---	---
Merrimac	132	Montague City, Franklin	Grasses and weeds, undisturbed	Terrace 3 percent	0-6	LS	85	9	6	2.23					1.20	44.7	22.7
					6-12	LS	76	19	5	1.98	--		Non-plastic		1.40	32.7	22.1
					12-18	LS	85	11	4	1.45					---	---	---
Merrimac	133	Montague City, Franklin	Grasses and weeds, undisturbed	Terrace 5 percent	0-6	LS	80	15	5	3.54					1.30	39.6	13.2
					6-12	LS	85	13	2	2.87	--		Non-plastic		1.43	32.9	10.6
					12-18	S	91	6	3	1.88					---	---	---
Merrimac	135	Turners Falls, Franklin	Pine, undisturbed	Terrace level	0-6	SL	70	24	6	3.27					1.21	45.4	24.1
					6-12	LS	78	15	7	1.88	--		Non-plastic		1.45	37.0	17.7
					12-18	LS	77	18	5	.55					---	---	---
Merrimac	136	Turners Falls, Franklin	Cherry and oak, undisturbed	Terrace level	0-6	LS	77	18	5	3.62					1.16	48.8	22.3
					6-12	SL	67	26	7	1.98	--		Non-plastic		1.35	38.1	16.5
					12-18	LS	78	16	6	.78					---	---	---
Ondawa	123	Knightville Dam, Hampshire	Grasses and weeds, undisturbed	Terrace level	0-6	SL	67	26	7	2.35					1.44	34.7	16.0
					6-12	LS	77	18	5	2.23	--		Non-plastic		1.41	35.5	18.4
					12-18	LS	79	17	4	.95					---	---	---
Rumney	124	Knightville Dam, Hampshire	Grasses and weeds, undisturbed	Bottom level	0-6	SL	62	27	11	3.77					1.13	51.0	41.7
					6-12	SL	59	29	12	1.33	--		Non-plastic		1.25	41.0	34.6
					12-18	SL	68	24	8	.62					---	---	---
Scarboro	134	Turners Falls, Franklin	Grasses and weeds, undisturbed	Terrace level	0-6	SL	52	31	17	6.28					1.04	64.7	56.5
					6-12	SL	58	31	11	4.70	--		Non-plastic		1.35	39.0	35.7
					12-18	SL	65	27	8	2.08					---	---	---
Suffield	129	Amherst, Hampshire	Grasses and weeds, undisturbed	Terrace level	0-6	SiCL	14	58	28	4.52					1.25	42.7	34.9
					6-12	SiL	16	59	25	3.77	--		Non-plastic		1.34	37.3	32.2
					12-18	SiL	14	66	20	3.41					---	---	---
Walpole*	120	Westfield, Hampden	Grasses and legumes, hay	Terrace level	0-6	L	47	36	17	5.02					1.08	55.6	39.9
					6-12	SL	54	31	15	3.69	5		Non-plastic		1.37	36.9	29.2
					12-18	SL	56	30	14	1.65					---	---	---
Woodbridge	125	Chesterfield, Hampshire	Grasses and weeds, undisturbed	Upland 5 percent	0-6	L	49	38	13	2.60					1.38	41.3	34.8
					6-12	SL	60	30	10	1.65	--		Non-plastic		1.57	28.7	23.3
					12-18	SL	56	33	11	1.33					---	---	---
Woodbridge	126	Chesterfield, Hampshire	Grasses and weeds, cultivated previously, now in hay	Upland level	0-6	L	39	43	18	5.34					1.13	54.3	42.8
					6-12	L	46	38	16	3.27	--		Non-plastic		1.31	43.5	36.9
					12-18	SL	53	32	15	1.33					---	---	---
Woodbridge	127	Chesterfield, Hampshire	Grasses and weeds, undisturbed	Upland 3 percent	0-6	L	49	38	13	7.18					1.04	64.6	49.4
					6-12	SL	52	38	10	5.39	--		Non-plastic		1.28	43.3	33.9
					12-18	SL	78	16	6	3.41					---	---	---

* Bulk density and moisture content values questionable.

Table 4. New Hampshire soil series: site descriptions and soil properties

Soil series	Site number	Weather station and county	Vegetation and land use	Topographic position and slope	Depths sampled inches	Texture class	Mechanical analysis by weight percent			Organic matter by weight percent	Stone content 0-18-in. depth by volume percent	Plasticity constants by weight percent			Bulk density grams per cc.	Soil moisture by weight, percent	
							Sand	Silt	Clay			Liquid limit	Plastic limit	Plasticity index		Saturation	.06 Atmosphere tension
Acton	140	Newport, Sullivan	Grasses and weeds, undisturbed	Upland 3 percent	0-6	SL	56	35	9	4.70					1.10	52.7	42.4
					6-12	SL	53	40	7	3.62	--		Non-plastic		1.09	54.8	47.0
					12-18	SL	53	40	7	2.23					---	---	---
Agawam	144	Claremont, Sullivan	Grasses and weeds, undisturbed	Terrace level	0-6	SiL	24	59	17	3.27					1.18	46.5	40.3
					6-12	SiL	32	53	15	3.13	--		Non-plastic		1.24	43.2	38.4
					12-18	SiL	19	69	12	1.45					---	---	---
Colton	142	Newport, Sullivan	Grasses and weeds, undisturbed	Terrace level	0-6	SL	56	32	12	6.51					.86	76.4	50.4
					6-12	SL	59	30	11	5.48	--		Non-plastic		1.26	43.1	30.6
					12-18	SL	62	30	8	5.12					---	---	---
Leicester	143	Claremont, Sullivan	Ash and elm, undisturbed	Upland level	0-6	L	38	47	15	4.38					1.19	47.6	35.9
					6-12	SiL	32	52	16	2.01	--		Non-plastic		1.47	31.9	27.1
					12-18	SiL	36	50	14	1.45					---	---	---
Merrimac	138	Milford, Hillsboro	Grasses and legumes, moderately grazed	Terrace 3 percent	0-6	SL	55	35	10	6.04					1.03	56.3	44.4
					6-12	SL	58	33	9	3.77	10		Non-plastic		1.15	54.4	38.0
					12-18	SCL	60	10	30	1.98					---	---	---
Rumney*	139	Milford, Hillsboro	Grasses and legumes, hay	Bottom level	0-6	SL	71	22	7	3.86					1.42	34.1	22.0
					6-12	SL	69	25	6	1.98	15		Non-plastic		1.70	22.8	14.7
					12-18	SL	72	17	7	1.55					---	---	---
Sudbury	141	Newport, Sullivan	Grasses and weeds, undisturbed	Terrace level	0-6	SL	55	30	15	5.46					.99	63.4	51.0
					6-12	L	45	42	13	3.86	--		Non-plastic		.95	64.7	58.3
					12-18	SL	55	36	9	3.69					---	---	---
Walpole*	137	Milford, Hillsboro	Grasses and legumes, hay	Terrace level	0-6	SL	59	30	11	4.54					.99	70.9	58.4
					6-12	SL	55	33	12	4.80	--		Non-plastic		1.67	24.4	19.0
					12-18	SL	56	34	10	1.77					---	---	---
Winooski	145	Claremont, Sullivan	Grasses and weeds, cultivated previously, now in hay	Bottom level	0-6	L	41	50	9	2.23					1.22	45.0	37.0
					6-12	L	46	46	8	2.60	--		Non-plastic		1.28	43.8	38.0
					12-18	L	50	42	8	1.88					---	---	---

* Bulk density and moisture content values questionable.

Table 5. New York soil series: site descriptions and soil properties

Soil series	Site number	Weather station and county	Vegetation and land use	Topographic position and slope	Depths sampled inches	Texture class	Mechanical analysis by weight percent			Organic matter by weight percent	Stone content 0-18-in. depth by volume percent	Plasticity constants by weight percent			Bulk density grams per cc.	Soil moisture by weight, percent	
							Sand	Silt	Clay			Liquid limit	Plastic limit	Plasticity index		Saturation	.06 Atmosphere tension
Albia	158	Schenectady, Schenectady	Oak, maple, elm, undisturbed	Upland level	0-6	CL	31	37	32	4.90					1.10	47.1	27.1
					6-12	CL	40	33	27	3.54	--		Non-plastic		1.45	32.3	21.6
					12-18	CL	27	39	34	1.45					---	---	---
Atherton*	156	Schaghticoke, Rensselaer	Birch and elm, undisturbed	Terrace level	0-6	CL	27	42	31	5.24					1.15	53.0	42.9
					6-12	L	30	48	22	1.98	--		Non-plastic		1.55	30.7	25.0
					12-18	L	30	49	21	.86					---	---	---
Berrien	58	Barker, Niagara	Grasses and weeds, undisturbed	Terrace 3 percent	0-6	SL	64	25	11	3.62					1.22	41.9	31.2
					6-12	SL	74	19	7	1.15	--		Non-plastic		1.52	26.6	22.4
					12-18	SL	64	26	10	.70					---	---	---
Brockport	72	Brockport, Monroe	Grasses and weeds, undisturbed	Upland 3 percent	0-6	CL	23	38	39	6.04					1.23	43.9	37.4
					6-12	CL	29	36	35	4.70	5	43	24	19	1.51	28.7	25.4
					12-18	C	12	33	55	1.65					---	---	---
Chenango	47	Salamanca, Cattaraugus	Grasses and weeds, undisturbed	Terrace level	0-6	SiL	26	53	21	5.46					.90	72.4	51.0
					6-12	SiL	25	52	23	4.15	5	34	28	6	1.18	43.8	35.6
					12-18	CL	23	48	29	3.00					---	---	---
Collamer	56	Barker, Niagara	Grasses and legumes, moderately grazed	Bottom level	0-6	SiCL	21	52	27	4.90					1.33	41.6	27.0
					6-12	SiCL	18	52	30	3.00	--		Non-plastic		1.40	37.8	27.7
					12-18	SiCL	18	52	30	1.25					---	---	---
Colonie	154	Schaghticoke, Rensselaer	Grasses and weeds, undisturbed	Upland 5 percent	0-6	L	42	43	15	1.88					1.35	38.4	29.5
					6-12	L	43	45	12	1.05	--		Non-plastic		1.53	31.5	24.3
					12-18	L	37	45	18	.95					---	---	---
Colwood	77	Rochester, Monroe	Grasses and weeds, undisturbed	Terrace level	0-6	L	51	38	11	14.84					1.06	54.2	43.3
					6-12	L	49	36	15	12.99	--		Non-plastic		1.16	46.6	40.8
					12-18	L	47	40	13	5.80					---	---	---
Dunkirk	57	Barker, Niagara	Grasses and legumes, moderately grazed	Upland 3 percent	0-6	L	38	46	16	5.02					1.28	39.8	31.9
					6-12	L	43	44	13	1.88	--		Non-plastic		1.45	30.9	25.6
					12-18	L	42	43	15	.95					---	---	---
Eel	61	Batavia, Genesee	Elm, undisturbed	Bottom level	0-6	L	33	42	25	5.80					.99	61.0	51.1
					6-12	L	35	39	26	5.34	--		Non-plastic		1.36	36.7	32.3
					12-18	L	45	34	21	2.87					---	---	---
Fulton	55	Wilson, Niagara	Grasses and weeds, undisturbed	Bottom level	0-6	L	42	38	20	4.70					1.37	34.3	29.1
					6-12	L	29	44	27	3.13	--	27	19	8	1.49	30.2	26.6
					12-18	SiC	13	40	47	.70					---	---	---
Galen	71	Brockport, Monroe	Grasses and weeds, undisturbed	Terrace 10 percent	0-6	SL	57	30	13	4.52					1.23	37.8	30.9
					6-12	SL	63	26	11	3.69	--		Non-plastic		1.36	34.6	27.6
					12-18	SL	58	32	10	1.77					---	---	---
Genesee	153	Schuylerville, Saratoga	Ash seedlings, grasses and weeds, undisturbed	Bottom 3 percent	0-6	CL	31	38	31	5.46					1.30	41.2	31.8
					6-12	CL	34	38	28	3.62	--		Non-plastic		1.55	28.4	21.1
					12-18	L	50	33	17	1.88					---	---	---
Hilton	75	Hilton, Monroe	Grasses and weeds, undisturbed	Bottom level	0-6	L	30	43	27	5.80					1.26	41.8	32.7
					6-12	L	31	43	26	4.52	5	28	20	8	1.53	28.8	23.7
					12-18	CL	22	41	37	1.45					---	---	---
Hudson	151	Schuylerville, Saratoga	Grasses and weeds, cultivated previously, now in hay	Terrace level	0-6	SiC	3	50	47	3.96					1.23	47.2	40.3
					6-12	SiC	2	49	49	2.47	--		Non-plastic		1.40	35.4	32.2
					12-18	SiC	2	49	49	1.05					---	---	---
Junius	53	Wilson, Niagara	Grasses and weeds, undisturbed	Bottom level	0-6	L	44	35	21	4.70					1.35	35.4	29.2
					6-12	L	46	36	18	2.60	--	25	21	4	1.48	30.0	25.6
					12-18	L	40	38	22	.70					---	---	---
Junius	54	Wilson, Niagara	Grasses and weeds, undisturbed	Bottom level	0-6	L	38	41	21	6.04					1.25	42.6	35.8
					6-12	L	36	42	22	2.79	--		Non-plastic		1.44	31.2	27.3
					12-18	L	40	39	21	1.05					---	---	---
Lakemont	49	Lockport, Niagara	Grasses and tree seedlings, cultivated previously, now in hay	Upland level	0-6	C	6	38	56	6.40					1.12	51.0	46.4
					6-12	C	3	29	68	3.41	--	57	27	30	1.43	33.5	30.0
					12-18	C	1	17	82	1.33					---	---	---
Lakemont	50	Lockport, Niagara	Grasses and weeds, cultivated previously, now in hay	Upland level	0-6	SiC	6	53	41	4.34					1.34	37.2	33.0
					6-12	SiC	7	53	40	2.23	--	38	23	15	1.44	32.7	29.0
					12-18	SiC	6	52	42	1.45					---	---	---

* Bulk density and moisture content values questionable.

(Continued)

Table 5. New York soil series: site descriptions and soil properties (continued)

Soil series	Site number	Weather station and county	Vegetation and land use	Topographic position and slope	Depths sampled inches	Texture class	Mechanical analysis by weight percent			Organic matter by weight percent	Stone content 0-18-in. depth by volume percent	Plasticity constants by weight percent			Bulk density grams per cc.	Soil moisture by weight, percent	
							Sand	Silt	Clay			Liquid limit	Plastic limit	Plasticity index		Saturation	.06 Atmosphere tension
Lockport	74	Hilton, Monroe	Grasses and weeds, cultivated previously, now in hay	Bottom level	0-6	C	19	36	45	5.56					1.39	33.9	30.0
					6-12	C	14	33	53	3.13	--	44	23	21	1.56	28.0	25.4
					12-18	C	11	30	59	1.45					---	---	---
Ovid	59	Batavia, Genesee	Grasses and weeds, undisturbed	Bottom 2 percent	0-6	L	43	41	16	6.40					1.06	54.9	42.1
					6-12	L	44	36	20	4.39	--	Non-plastic			1.16	47.6	41.1
					12-18	SL	54	29	17	1.33					---	---	---
Ovid	60	Batavia, Genesee	Alfalfa, cultivated previously, now in hay	Bottom 2 percent	0-6	SiCL	19	48	33	5.68					1.13	50.5	45.0
					6-12	CL	21	43	36	5.68	--	49	36	13	1.08	53.2	47.8
					12-18	CL	25	42	33	2.75					---	---	---
Rhinebeck	152	Schuylerville, Saratoga	Grasses and oak trees, moderately grazed	Bottom level	0-6	SiC	10	47	43	5.92					1.28	43.8	33.0
					6-12	SiC	6	43	51	2.23	--	Non-plastic			1.46	34.2	29.6
					12-18	C	2	35	63	1.15					---	---	---
Romulus	76	Hilton, Monroe	Grasses and weeds, undisturbed	Upland level	0-6	CL	29	42	29	3.27					1.57	27.7	23.8
					6-12	SiCL	19	43	38	1.05	--	32	15	17	1.74	21.5	19.0
					12-18	C	18	38	44	.86					---	---	---
Schoharie	52	Lockport, Niagara	Grasses and weeds, cultivated previously, now in hay	Upland level	0-6	SiC	13	42	45	5.34					1.21	43.9	37.9
					6-12	C	10	38	52	1.65	--	46	24	22	1.48	32.0	29.1
					12-18	C	3	37	60	1.15					---	---	---
Swanton	155	Schaghticoke, Rensselaer	Elm, undisturbed	Terrace level	0-6	L	50	40	10	1.45					1.29	56.1	34.1
					6-12	L	48	44	8	.86	--	Non-plastic			1.53	29.1	23.0
					12-18	L	42	48	10	.70					---	---	---
Tonawanda	80	Rochester, Monroe	Scattered elm and ash, grasses and weeds, undisturbed	Bottom level	0-6	SiCL	10	52	38	6.60					1.10	53.9	43.7
					6-12	SiCL	9	55	36	5.56	--	53	35	18	1.24	42.9	37.4
					12-18	SiCL	8	53	39	4.60					---	---	---
Tyler*	46	Salamanca, Cattaraugus	Elm and maple, undisturbed	Terrace level	0-6	SiC	12	41	47	24.74					.67	109.9	89.1
					6-12	SiC	3	43	54	9.76	--	63	40	23	.97	65.5	59.7
					12-18	SiC	2	51	47	4.70					---	---	---
Unadilla	44	Olean, Cattaraugus	Grasses and weeds, undisturbed	Terrace level	0-6	SiL	17	60	23	3.69					1.08	53.0	43.4
					6-12	SiL	17	56	27	.95	--	27	21	6	1.37	37.0	32.9
					12-18	SiL	15	58	27	.78					---	---	---
Unadilla	45	Olean, Cattaraugus	Aspen, undisturbed	Terrace level	0-6	SiL	16	61	23	2.75					1.07	51.4	40.3
					6-12	SiL	13	61	26	1.05	--	28	22	6	1.38	34.9	31.5
					12-18	SiL	14	64	22	.78					---	---	---
Unadilla	48	Salamanca, Cattaraugus	Grasses and weeds, undisturbed	Terrace level	0-6	CL	24	48	28	3.62					1.10	51.9	46.1
					6-12	CL	23	49	28	1.45	--	Non-plastic			1.40	32.7	29.2
					12-18	L	27	47	26	.86					---	---	---
Wolcottsburg	79	Rochester, Monroe	Grasses and weeds, undisturbed	Bottom level	0-6	SiC	6	47	47	3.54					1.29	43.1	36.5
					6-12	SiC	5	49	46	.70	--	37	25	12	1.60	28.1	25.1
					12-18	SiC	3	54	43	.46					---	---	---
Wolcottsburg*	78	Rochester, Monroe	Grasses and weeds, undisturbed	Bottom level	0-6	SiC	10	44	46	14.65					.70	103.4	40.9
					6-12	SiC	11	46	43	11.45	--	Non-plastic			.83	83.2	76.5
					12-18	SiCL	16	46	38	6.52					---	---	---

* Bulk density and moisture content values questionable.

Table 6. Pennsylvania soil series: site descriptions and soil properties

Soil series	Site number	Weather station and county	Vegetation and land use	Topographic position and slope	Depths sampled inches	Texture class	Mechanical analysis by weight percent			Organic matter by weight percent	Stone content 0-18-in. depth by volume percent	Plasticity constants by weight percent			Bulk density grams per cc.	Soil moisture by weight, percent	
							Sand	Silt	Clay			Liquid limit	Plastic limit	Plasticity index		Saturation	.06 Atmosphere tension
Andover	16	Huntingdon, Huntingdon	Grasses and weeds, undisturbed	Terrace 4 percent	0-6	SiCL	19	49	32	1.65					1.37	35.8	30.9
					6-12	SiCL	20	49	31	1.45	--	28	20	8	1.49	29.4	26.0
					12-18	SiCL	15	50	35	.78					---	---	---
Araby	70	Millheim, Centre	Grasses and weeds, cultivated previously, now in hay	Upland level	0-6	SiCL	8	54	38	3.41					1.36	36.4	31.6
					6-12	SiC	7	53	40	3.41	--	37	25	12	1.41	35.3	31.1
					12-18	SiC	8	51	41	1.45					---	---	---
Atkins	20	Saxton, Bedford	Pines, undisturbed	Bottom level	0-6	CL	29	37	34	2.08					1.38	35.0	29.4
					6-12	CL	28	36	36	.70	--	25	18	7	1.67	22.6	19.2
					12-18	C	26	33	41	.70					---	---	---
Atkins	32	Whitesburg, Armstrong	Grasses and weeds, undisturbed	Bottom level	0-6	CL	28	37	35	2.87					1.39	36.6	32.3
					6-12	CL	28	38	34	2.75	--	34	20	10	1.43	32.8	28.9
					12-18	CL	35	35	30	1.05					---	---	---
Braceville	39	Meadville, Crawford	Grasses and weeds, cultivated previously, now in hay	Terrace 6 percent	0-6	L	33	48	19	4.15					1.22	43.3	32.8
					6-12	L	31	47	22	2.60	10	26	21	5	1.40	32.8	26.2
					12-18	L	40	43	17	1.77					---	---	---
Brinkerton*	34	East Brady, Armstrong	Grasses and weeds, undisturbed	Bottom 3 percent	0-6	C	18	34	48	6.88					.67	121.1	106.1
					6-12	CL	34	32	34	4.84	5	44	26	18	1.42	37.6	33.6
					12-18	CL	36	31	33	4.05					---	---	---
Canfield	4	Pikes Creek, Luzerne	Oak, beech, hickory, undisturbed	Upland 3 percent	0-6	SiCL	19	54	27	4.52					.94	68.6	50.4
					6-12	SiCL	19	54	27	1.88	20	32	23	9	1.46	30.9	25.6
					12-18	SiCL	17	55	28	1.05					---	---	---
Clymer	25	Strongstown, Indiana	Grasses and weeds, cultivated previously, now in hay	Upland 6 percent	0-6	CL	26	41	33	3.54					1.33	36.9	30.6
					6-12	CL	26	39	35	2.08	10	32	21	11	1.56	27.4	23.9
					12-18	CL	26	42	32	.86					---	---	---
Clymer	26	Strongstown, Indiana	Hemlock and oak, undisturbed	Upland 6 percent	0-6	CL	21	47	32	6.13					1.09	53.1	44.6
					6-12	SiCL	17	44	39	2.68	20	34	23	11	1.24	43.4	36.0
					12-18	SiCL	19	43	38	1.65					---	---	---
Duffield	22	Martinsburg, Blair	Pine and spruce, undisturbed	Upland 6 percent	0-6	SiC	12	45	43	3.41					1.27	40.2	29.7
					6-12	C	6	36	58	1.65	5	41	24	17	1.40	35.2	28.9
					12-18	C	3	31	66	1.33					---	---	---
Duffield	23	Martinsburg, Blair	Grasses and alfalfa, cultivated previously, now in hay	Upland 6 percent	0-6	SiCL	14	48	38	1.65					1.46	30.9	26.6
					6-12	SiC	10	50	40	1.45	5	33	23	10	1.47	30.7	25.6
					12-18	C	7	39	54	.55					---	---	---
Dunmore	69	Millheim, Centre	Grasses and weeds, undisturbed	Upland 10 percent	0-6	SiC	4	52	44	4.15					1.29	41.0	34.6
					6-12	SiC	3	47	50	2.47	--	50	24	26	1.54	29.0	36.0
					12-18	C	2	36	62	.95					---	---	---
Elkins	18	Saxton, Bedford	Grasses, weeds and legumes, moderately grazed	Bottom level	0-6	SiC	7	50	43	5.12					1.21	42.7	37.3
					6-12	SiC	4	52	44	4.53	--	44	30	14	1.34	38.8	35.0
					12-18	SiC	8	48	44	3.13					---	---	---
Elkins	19	Saxton, Bedford	Grasses and weeds, undisturbed	Bottom 2 percent	0-6	C	40	19	41	4.15					1.30	42.1	35.6
					6-12	L	38	39	23	3.54	--	Non-plastic			1.25	44.6	40.6
					12-18	L	43	35	22	2.47					---	---	---
Ernest	28	Indiana, Indiana	Grasses and legumes, moderately grazed	Upland level	0-6	CL	32	35	33	3.27					1.33	41.6	35.9
					6-12	CL	32	34	34	2.35	--	37	24	13	1.43	33.1	29.2
					12-18	CL	32	34	34	1.15					---	---	---
Ernest	30	Indiana, Indiana	Grasses and weeds, cultivated previously, now in hay	Upland level	0-6	SiCL	16	49	35	3.62					1.17	48.6	40.0
					6-12	SiCL	20	47	33	1.98	--	35	24	11	1.42	33.6	29.3
					12-18	CL	25	42	33	1.05					---	---	---
Ernest	31	Whitesburg, Armstrong	Grasses and weeds, cultivated previously, now in hay	Upland 10 percent	0-6	CL	32	38	30	2.35					1.44	33.5	27.1
					6-12	CL	25	42	33	1.25	--	26	19	7	1.60	26.1	20.8
					12-18	CL	23	45	32	1.25					---	---	---
Frenchtown	43	Meadville, Crawford	Grasses and weeds, undisturbed	Upland level	0-6	SiCL	15	57	28	6.04					1.02	61.3	49.2
					6-12	SiCL	13	56	31	5.12	5	45	34	11	1.22	46.3	38.7
					12-18	SiCL	18	55	27	3.41					---	---	---

* Bulk density and moisture content values questionable.

(Continued)

Table 6. Pennsylvania soil series: site descriptions and soil properties (continued)

Soil series	Site number	Weather station and county	Vegetation and land use	Topographic position and slope	Depths sampled inches	Texture class	Mechanical analysis by weight percent			Organic matter by weight percent	Stone content 0-18-in. depth by volume percent	Plasticity constants by weight percent			Bulk density grams per cc.	Soil moisture by weight, percent	
							Sand	Silt	Clay			Liquid limit	Plastic limit	Plasticity index		Saturation	.06 Atmosphere tension
Gilpin	27	Indiana, Indiana	Grasses and legumes, hay	Upland 10 percent	0-6	CL	23	42	35	3.62					1.44	33.2	27.1
					6-12	CL	25	41	34	1.77	15	32	22	10	1.48	31.6	26.8
					12-18	SiCL	18	44	38	1.15					---	---	---
Guthrie	21	Martinsburg, Blair	Grasses and weeds, cultivated previously, now in hay	Upland 3 percent	0-6	SiC	8	52	40	4.90					1.20	46.2	38.8
					6-12	SiC	7	53	40	2.75	--	40	25	15	1.48	30.8	27.1
					12-18	SiC	7	53	40	2.08					---	---	---
Hagerstown	11	State College, Centre	Oaks, undisturbed	Upland level	0-6	CL	22	49	29	1.25					1.33	37.8	29.8
					6-12	SiCL	19	51	30	.86	10	26	18	8	1.62	24.9	21.0
					12-18	SiCL	19	43	38	.70					---	---	---
Holly	8	Dixon, Wyoming	Grasses and weeds, cultivated previously, now in hay	Bottom level	0-6	L	32	42	26	2.87					1.28	39.9	35.1
					6-12	L	42	36	22	1.45	--	25	23	2	1.54	27.9	24.3
					12-18	SL	64	22	14	.78					---	---	---
Holly	36	Meadville, Crawford	Grasses and weeds, undisturbed	Bottom level	0-6	SiL	20	54	26	5.12					1.15	50.9	44.1
					6-12	SiCL	17	52	31	4.60	--	40	26	14	1.24	44.0	39.8
					12-18	SiCL	14	47	39	4.05					---	---	---
Holly	37	Meadville, Crawford	Grasses and legumes, moderately grazed	Bottom level	0-6	SiL	23	55	22	2.75					1.36	36.2	31.8
					6-12	SiL	23	58	19	2.35	--	30	23	7	1.21	44.7	40.7
					12-18	SiL	19	56	25	2.35					---	---	---
Holly	38	Meadville, Crawford	Elm trees, grasses and legumes, lightly grazed	Bottom level	0-6	SiCL	13	59	28	4.70					1.30	39.1	33.5
					6-12	SiC	9	55	36	4.05	--	41	29	12	1.18	46.3	40.8
					12-18	SiC	12	49	39	3.77					---	---	---
Hublersburg	12	State College, Centre	Grasses and weeds, aspen seedlings and saplings, undisturbed	Upland level	0-6	SL	72	14	14	.78					1.57	26.1	16.3
					6-12	SCL	65	15	20	.55	--	Non-plastic			1.69	21.7	15.9
					12-18	SCL	64	10	26	.25					---	---	---
Hublersburg	13	State College, Centre	Aspen saplings, undisturbed	Upland level	0-6	SL	71	16	13	1.25					1.36	36.4	18.6
					6-12	SL	69	16	15	.95	10	Non-plastic			1.69	21.9	12.7
					12-18	SCL	63	15	22	.62					---	---	---
Huntington	10	State College, Centre	Grasses and legumes, moderately grazed	Bottom level	0-6	CL	29	41	30	4.05					1.28	41.2	32.7
					6-12	CL	34	36	30	2.47	10	31	22	9	1.49	30.9	25.2
					12-18	L	41	33	26	1.15					---	---	---
Huntington	65	Watsontown, Union	Grasses and weeds, undisturbed	Bottom 5 percent	0-6	L	38	41	21	5.92					.96	67.2	50.4
					6-12	L	47	33	20	4.15	--	Non-plastic			1.14	50.1	34.0
					12-18	SL	60	26	14	1.98					---	---	---
Huntington	66	Watsontown, Union	Grasses, weeds and scattered maples, undisturbed	Bottom 3 percent	0-6	L	41	35	24	4.05					.96	63.0	43.4
					6-12	SL	62	23	15	2.60	--	Non-plastic			1.21	44.6	28.8
					12-18	SL	61	24	15	1.77					---	---	---
Lackawanna	3	Retreat, Luzerne	Weeds and sumac, undisturbed	Upland 5 percent	0-6	SiL	28	52	20	4.15					1.22	41.8	31.0
					6-12	SiL	28	52	20	1.77	15	26	22	4	1.51	28.5	25.3
					12-18	SiL	24	50	26	.70					---	---	---
Lickdale	29	Indiana, Indiana	Grasses and weeds, undisturbed	Upland 3 percent	0-6	CL	33	38	29	6.66					1.22	46.9	40.2
					6-12	CL	33	37	30	4.72	15	35	24	11	1.42	34.7	28.9
					12-18	CL	32	37	31	3.13					---	---	---
Lindside	17	Huntingdon, Huntingdon	Grasses and weeds, undisturbed	Bottom level	0-6	CL	28	38	34	4.80					1.36	37.3	30.6
					6-12	CL	29	41	30	4.91	10	41	26	15	1.36	35.1	30.2
					12-18	CL	24	43	33	3.77					---	---	---
Melvin	67	Watsontown, Union	Grasses and weeds, cultivated previously, now in hay	Bottom level	0-6	SiCL	11	54	35	3.41					1.33	38.6	32.4
					6-12	SiCL	9	52	39	1.25	--	37	24	13	1.40	36.0	32.4
					12-18	SiCL	10	56	34	.55					---	---	---
Papakating*	5	Pikes Creek, Luzerne	Grasses and weeds, undisturbed	Bottom level	0-6	CL	20	43	37	26.29					.56	135.5	120.5
					6-12	L	33	47	20	21.85	--	Non-plastic			.53	141.8	133.3
					12-18	L	34	47	19	4.90					---	---	---

* Bulk density and moisture content values questionable.

(Continued)

Table 6. Pennsylvania soil series: site descriptions and soil properties (continued)

Soil series	Site number	Weather station and county	Vegetation and land use	Topographic position and slope	Depths sampled inches	Texture class	Mechanical analysis by weight percent			Organic matter by weight percent	Stone content 0-18-in. depth by volume percent	Plasticity constants by weight percent			Bulk density grams per cc.	Soil moisture by weight, percent	
							Sand	Silt	Clay			Liquid limit	Plastic limit	Plasticity index		Saturation	.06 Atmosphere tension
Philo	33	Whitesburg, Armstrong	Cherry, undisturbed	Bottom level	0-6	CL	21	44	35	3.13					1.20	46.8	38.2
					6-12	CL	20	44	36	2.87	--	38	25	13	1.39	34.6	30.9
					12-18	CL	23	41	36	1.98					---	---	---
Philo	35	East Brady, Armstrong	Grasses and weeds, cultivated previously, now in hay	Bottom level	0-6	L	38	36	26	5.34					1.13	52.3	40.6
					6-12	CL	36	37	27	4.90	--	37	25	12	1.40	34.4	30.9
					12-18	CL	30	38	32	5.34					---	---	---
Pope*	24	Strongstown, Indiana	Beech and maple, undisturbed	Bottom level	0-6	SL	69	17	14	7.21					1.17	47.3	25.0
					6-12	SL	67	20	13	3.47	--	Non-plastic			1.05	57.5	35.6
					12-18	SL	72	15	13	1.65					---	---	---
Tioga	1	Retreat, Luzerne	Grasses and weeds, undisturbed	Bottom level	0-6	L	34	45	21	.95					1.43	32.1	27.0
					6-12	L	46	39	15	.78	--	27	22	5	1.60	25.2	21.8
					12-18	L	36	45	19	.70					---	---	---
Tioga	2	Retreat, Luzerne	Sycamore and hickory, undisturbed	Bottom level	0-6	SL	67	24	9	2.08					.98	53.7	32.2
					6-12	SL	53	34	13	1.55	--	Non-plastic			1.14	44.2	33.7
					12-18	SL	56	31	13	.95					---	---	---
Tioga	7	Dixon, Wyoming	Hickory and cherry, undisturbed	Terrace 10 percent	0-6	SL	72	19	9	2.60					1.16	51.9	31.1
					6-12	SL	65	22	13	1.15	--	Non-plastic			1.42	34.3	22.4
					12-18	SL	71	19	10	.55					---	---	---
Tioga	9	Dixon, Wyoming	Birch and sycamore, undisturbed	Bottom level	0-6	SL	58	30	12	1.77					1.38	34.3	23.9
					6-12	SL	68	20	12	.86	5	Non-plastic			1.46	29.6	16.8
					12-18	SL	70	19	11	.38					---	---	---
Tioga	40	Meadville, Crawford	Grasses and weeds, undisturbed	Bottom level	0-6	L	32	47	21	5.02					1.23	43.0	33.3
					6-12	L	32	49	19	4.34	--	Non-plastic			1.27	41.2	33.2
					12-18	SiL	26	51	23	3.54					---	---	---
Tioga	41	Meadville, Crawford	Grasses and weeds, undisturbed	Bottom level	0-6	SiL	23	55	22	4.34					1.19	45.7	37.9
					6-12	L	33	48	19	2.47	--	Non-plastic			1.38	34.3	28.2
					12-18	L	31	48	21	1.98					---	---	---
Tioga	42	Meadville, Crawford	Crab apple trees, undisturbed	Bottom level	0-6	SiL	25	57	18	4.15					1.24	42.2	33.6
					6-12	L	33	48	19	3.62	--	Non-plastic			1.23	43.4	35.1
					12-18	SiL	21	57	22	3.13					---	---	---
Tioga	62	Covington, Tioga	Grasses, weeds, and sugar maple trees, undisturbed	Bottom 2 percent	0-6	L	29	50	21	4.15					1.21	44.6	31.4
					6-12	L	37	42	21	3.54	--	Non-plastic			1.26	40.6	29.9
					12-18	L	31	46	23	3.27					---	---	---
Tioga	63	Covington, Tioga	Grasses and weeds, cultivated previously, now in hay	Bottom 2 percent	0-6	CL	25	47	28	4.90					1.27	41.9	30.7
					6-12	SiCL	19	52	29	1.77	--	31	22	9	1.38	35.4	26.1
					12-18	CL	26	45	29	.78					---	---	---
Tioga	64	Covington, Tioga	Cherry and shadbush, undisturbed	Bottom 2 percent	0-6	L	35	48	17	5.80					1.00	62.8	48.8
					6-12	L	47	37	16	2.23	--	Non-plastic			1.27	41.6	34.0
					12-18	L	38	44	18	1.15					---	---	---
Wheeling	68	Watsontown, Union	Grasses and weeds, cultivated previously, now in hay	Terrace 3 percent	0-6	SiCL	16	54	30	2.47					1.35	36.9	29.5
					6-12	SiCL	12	55	33	1.25	--	30	21	9	1.46	31.4	26.8
					12-18	SiCL	14	52	34	.46					---	---	---
Wiltshire	14	State College, Centre	Red pine, undisturbed	Upland 10 percent	0-6	CL	20	53	27	3.62					1.34	36.3	27.3
					6-12	CL	26	45	29	3.27	10	31	23	8	1.24	42.6	32.1
					12-18	CL	21	46	33	2.60					---	---	---
Wiltshire	15	State College, Centre	Grasses, weeds, and ash seedlings, undisturbed	Upland 10 percent	0-6	SiCL	15	47	38	7.18					1.21	42.7	35.8
					6-12	SiCL	11	51	38	1.65	--	33	22	11	1.58	27.1	24.2
					12-18	SiCL	9	52	39	1.65					---	---	---
Woostern	6	Pikes Creek, Luzerne	Grasses and weeds, cultivated previously, now in hay	Upland 3 percent	0-6	SiL	19	56	25	3.00					1.13	49.5	30.6
					6-12	SiL	23	58	19	2.23	20	32	24	8	1.24	43.4	30.2
					12-18	SiL	20	54	26	1.98					---	---	---

* Bulk density and moisture content values questionable.

Table 7. Vermont soil series: site descriptions and soil properties

Soil series	Site number	Weather station and county	Vegetation and land use	Topographic position and slope	Depths sampled inches	Texture class	Mechanical analysis by weight percent			Organic matter by weight percent	Stone content 0-18-in. depth by volume percent	Plasticity constants by weight percent			Bulk density grams per cc.	Soil moisture by weight, percent	
							Sand	Silt	Clay			Liquid limit	Plastic limit	Plasticity index		Saturation	.06 Atmosphere tension
Buxton	146	White River Junction, Windsor	Grasses and weeds, undisturbed	Terrace 20 percent	0-6	SiCL	10	59	31	1.33					1.26	43.3	37.6
					6-12	SiCL	8	60	32	.86	--	Non-plastic			1.39	36.0	32.5
					12-18	SiCL	7	61	32	.70					---	---	---
Buxton	147	White River Junction, Windsor	Pine, birch, poplar, undisturbed	Terrace level	0-6	L	37	38	25	2.60					1.17	49.7	38.9
					6-12	SiCL	4	61	35	.78	--	Non-plastic			1.43	33.8	28.6
					12-18	SiC	1	52	41	.70					---	---	---
Ondawa	150	Woodstock, Windsor	Grasses and legumes, hay	Terrace 5 percent	0-6	L	48	36	16	5.72					.99	59.5	46.8
					6-12	SL	53	34	13	6.11	--	Non-plastic			.87	82.2	73.2
					12-18	SL	67	23	10	5.12					---	---	---
Scarboro	149	Woodstock, Windsor	Maples, undisturbed	Terrace level	0-6	L	46	39	15	6.20					.86	78.7	59.9
					6-12	L	46	41	13	3.15	--	Non-plastic			.94	69.0	62.6
					12-18	L	50	36	14	1.33					---	---	---
Sudbury*	148	Woodstock Windsor	Grasses and weeds, undisturbed	Terrace level	0-6	L	40	42	18	4.15					1.11	52.1	45.2
					6-12	L	41	44	15	3.62	--	Non-plastic			1.35	37.0	31.0
					12-18	L	41	44	15	2.60					---	---	---

* Bulk density and moisture content values questionable.

Table 8. Average organic-matter content and bulk density

Vegetation	Organic-matter content				Bulk density			
	Soil texture				Soil texture			
	Coarse	Medium	Fine	Average	Coarse	Medium	Fine	Average
	Percent by weight				Gm per cc.			
0 TO 6-INCH DEPTH								
Forest	(13) 2.87	(13) 4.04	(14) 5.85	4.25	(13) 1.20	(13) 1.08	(14) 1.18	1.15
Herbaceous	(15) 4.09	(21) 4.26	(26) 5.34	4.56	(15) 1.17	(21) 1.20	(26) 1.21	1.19
Grass	(3) 2.55	(16) 4.81	(13) 4.13	3.83	(3) 1.41	(16) 1.21	(13) 1.28	1.30
Average	3.17	4.37	5.11	4.21	1.26	1.16	1.22	1.21
6 TO 12-INCH DEPTH								
Forest	(13) 1.70	(14) 2.40	(13) 3.13	2.41	(13) 1.42	(14) 1.34	(13) 1.37	1.38
Herbaceous	(17) 2.52	(22) 4.00	(23) 2.76	3.09	(17) 1.43	(22) 1.30	(23) 1.41	1.38
Grass	(5) 3.91	(12) 2.84	(15) 2.86	3.20	(5) 1.26	(12) 1.39	(15) 1.47	1.37
Average	2.71	3.08	2.92	2.90	1.37	1.34	1.42	1.38

Note: Numbers in parentheses give number of observations on which the average is based.

Table 9. Average soil moisture, in percent by volume

Vegetation	At saturation				At 0.06 atm. tension			
	Soil texture				Soil texture			
	Coarse	Medium	Fine	Average	Coarse	Medium	Fine	Average
	Percent by volume							
0 TO 6-INCH DEPTH								
Forest	(13) 54.5	(13) 60.1	(14) 55.5	56.7	(13) 31.7	(13) 43.8	(14) 43.2	39.6
Herbaceous	(15) 56.7	(21) 55.7	(26) 55.3	55.9	(15) 39.8	(21) 44.3	(26) 46.9	43.7
Grass	(3) 45.8	(16) 55.1	(13) 54.0	51.6	(3) 28.9	(16) 43.9	(13) 45.2	39.3
Average	52.3	57.0	54.9	54.7	33.5	44.0	45.1	40.9
6 TO 12-INCH DEPTH								
Forest	(13) 47.4	(14) 50.6	(13) 49.4	49.1	(13) 27.8	(14) 40.9	(13) 41.1	36.6
Herbaceous	(17) 47.4	(22) 51.9	(23) 48.9	49.4	(17) 35.2	(22) 43.9	(23) 42.5	40.5
Grass	(5) 54.9	(12) 47.5	(15) 47.0	49.8	(5) 42.1	(12) 39.7	(15) 40.9	40.9
Average	49.9	50.0	48.4	49.4	35.0	41.5	41.5	39.3

Note: Numbers in parentheses give number of observations on which the average is based.

Table 10. Summary of regression computations

	Equation	Standard error of estimate gm per cc.
	0 TO 6-INCH DEPTH	
(1)	BD = 1.2349 - 0.0369 (OM%) + 0.0038 (C%) + 0.0011 (S%)	0.133
(2)	BD = 1.3124 - 0.0368 (OM%) + 0.0022 (C%)	.133
(3)	BD = 1.3546 - 0.0346 (OM%)	.135
(4)	BD = 1.4520 - 0.0653 (OM%) + 0.0013 $(OM\%)^2$	.130
(5)	BD = 1.6492 - 0.6452 Log (OM + 1) %	.130
(6)	BD = 1.8160 - 0.7891 Log (OM + 2) %	.130
(7)	BD = 1.8014 - 0.8491 Log (OM + 2) % + 0.0026 (C%)	.127
	6 TO 12-INCH DEPTH	
(8)	BD = 1.2498 - 0.0487 (OM%) + 0.0063 (C%) + 0.0034 (S%)	0.134
(9)	BD = 1.4863 - 0.0498 (OM%) + 0.0017 (C%)	.138
(10)	BD = 1.5246 - 0.0491 (OM%)	.139
(11)	BD = 1.5548 - 0.0064 (OM%) + 0.0009 $(OM\%)^2$	.138
(12)	BD = 1.7200 - 0.6236 Log (OM + 1) %	.141
(13)	BD = 1.9024 - 0.7897 Log (OM + 2) %	.140
(14)	BD = 2.2764 - 1.0882 Log (OM + 4) %	.140

BD = bulk density in grams per cubic centimeter.
C = clay content.
S = sand content.
OM = organic-matter content.

Table 11. Correlation coefficients indicating relationships among bulk density (BD), organic-matter (OM), sand (S), and clay (C) content

Characteristics	Total correlation coefficient[1]	Partial correlation coefficient[2]
0 TO 6-INCH DEPTH		
BD and C(%)	-0.032	
Independent of Log (OM + 2) %		+0.232*
BD and Log (OM + 2) %	-0.673*	
Independent of C(%)		-0.694*
C(%) and Log (OM + 2) %	+0.291*	
Independent of BD		+0.364*
Multiple correlation Log (OM + 2) %, C(%), and BD	0.695*	
6 TO 12-INCH DEPTH		
BD and C(%)	+0.074	
Independent of OM(%) and S(%)		+0.309*
BD and OM(%)	-0.658*	
Independent of C(%) and S(%)		-0.671*
BD and S(%)	+0.064	
Independent of C(%) and OM(%)		+0.267**
C(%) and OM(%)	+0.073	
Independent of BD and S(%)		+0.156
S(%) and OM(%)	+0.101	
Independent of BD and C(%)		+0.087
Multiple correlation OM(%), C(%), S(%), and BD	0.698*	

* Significant at 1 percent level. ** Significant at 5 percent level.

[1]Total correlation indicates the simple relationship between the two factors considered.

[2]Partial correlations are estimates of the correlation between the two indicated variables in a population whose members all have the same third variable or the same third and fourth variable.